AIRS assimilation at ECMWF

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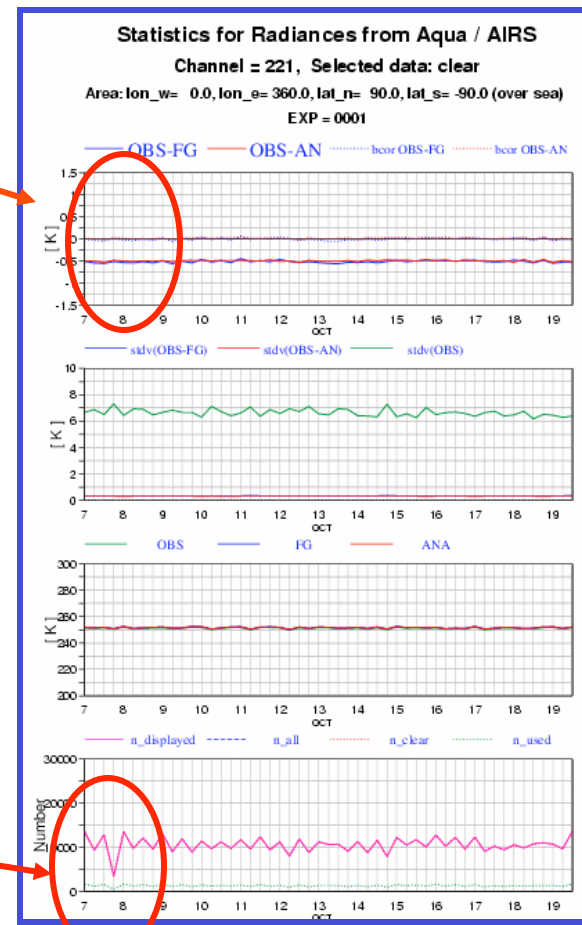
Operational Status

- The day-1 AIRS assimilation configuration (reported at last meeting) was handed over to ECMWF-operations in August (for integration and critical testing).

- The AIRS was packaged with a number of other system changes (including the assimilation of AQUA-AMSUA)

- Full system (named EC-CY26R3) was run in parallel and officially "switched" on the 7th October.

- No problems have been experienced since operational implementation (other than the AQUA manoeuvre)

Good news about the AQUA Manoeuvre (7 October 2003)

no change in obs minus calc statistics

Following the shut-down of the AIRS no disruption or change to the radiance data quality has been observed

data lost

Statistics for Radiances from Aqua / AIRS
Channel = 221, Selected data: clear
Area: lon_w= 0.0, lon_e= 360.0, lat_n= 90.0, lat_s= -90.0 (over sea)
EXP = 0001

Modifications to AIRS system currently being tested

• Upgrade to cloud detection scheme for water vapour channels

• Improved treatment of systematic errors (bias correction)

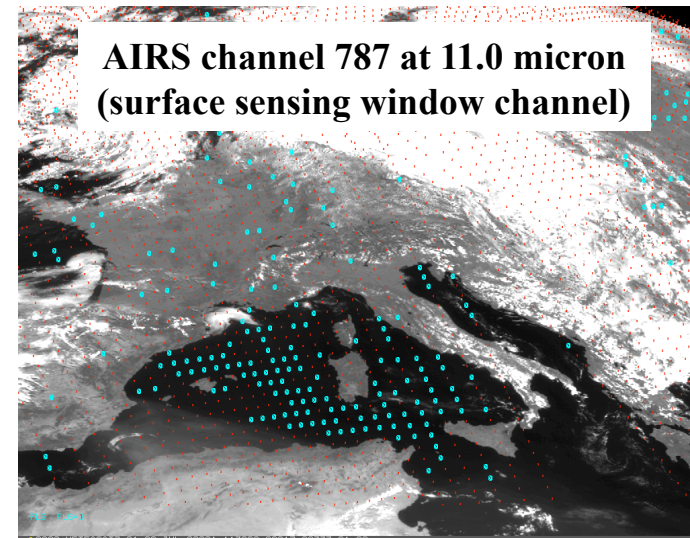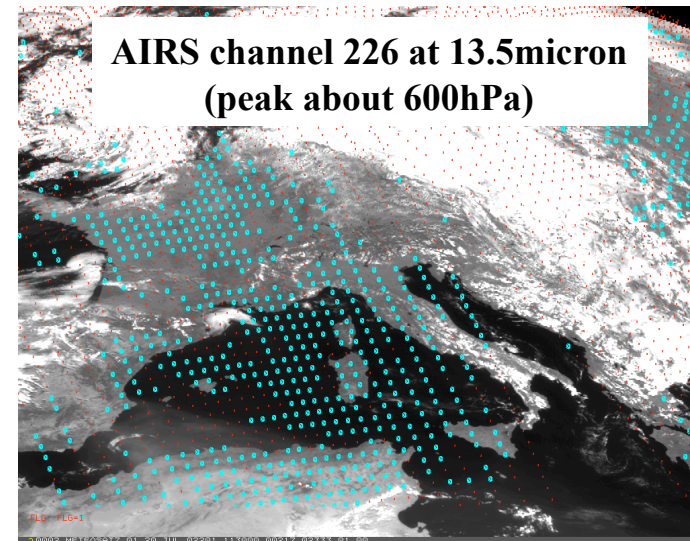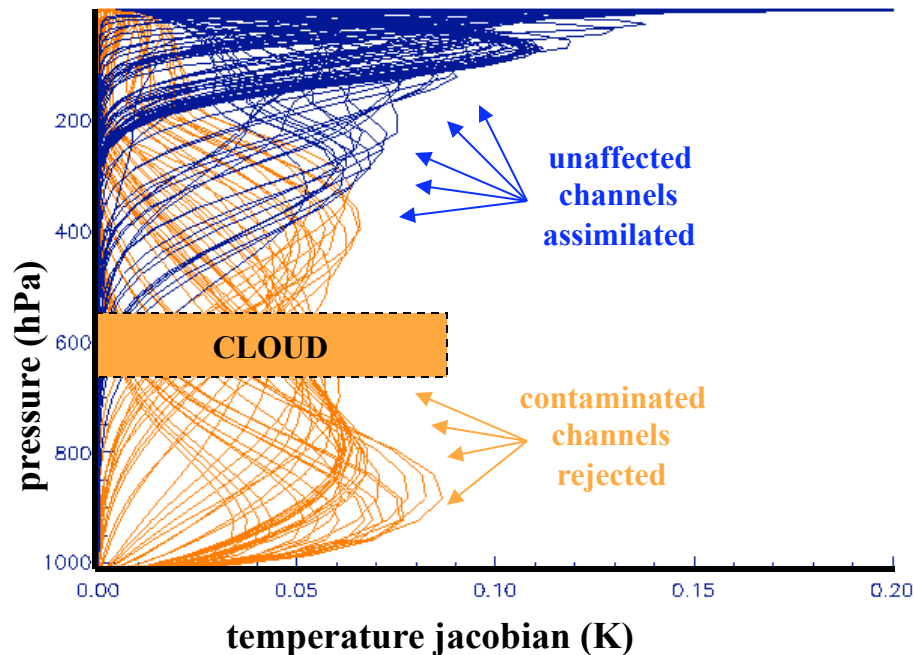• Control of increments due to AIRS in the stratosphere/mesosphere

Cloud detection

Cloud detection scheme for AIRS (IASI / CrIS)

A non-linear pattern recognition algorithm is applied to departures of the observed radiance spectra from a computed clear-sky background spectra.


Vertically ranked channel index
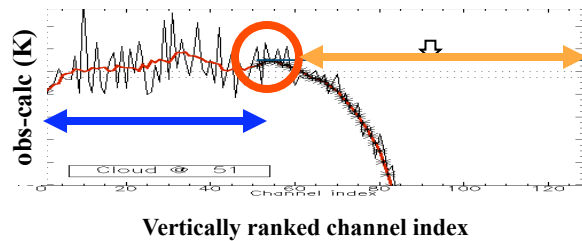
This identifies the characteristic signal of cloud in the data and allows contaminated channels to be rejected

unaffected channels assimilated

CLOUD

contaminated channels rejected

pressure (hPa)

temperature jacobian (K)

AIRS channel 226 at 13.5micron (peak about 600hPa)

AIRS channel 787 at 11.0 micron (surface sensing window channel)

Upgrade to the AIRS cloud detection scheme for water vapour channels

A significant number of cases were observed where the cloud detection scheme was being "fooled" by large errors in the background estimate of the humidity profile.
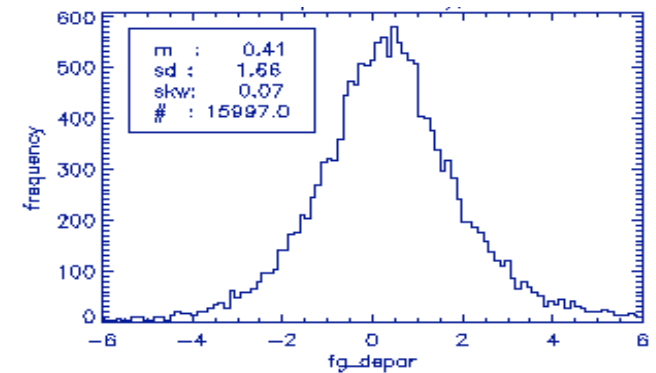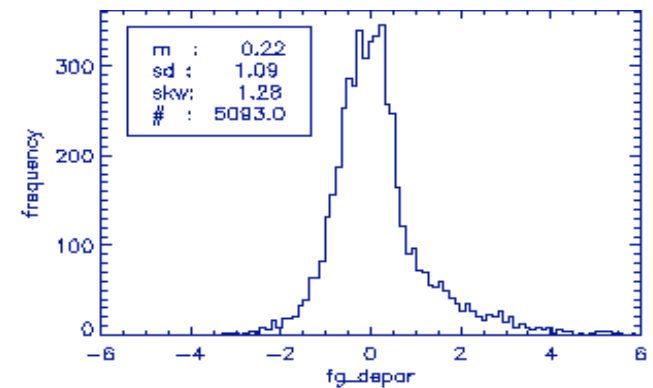
This has been solved by passing cloud signal information from similarly peaking (dry) channels in the 15 micron band

AIRS 15 micron band

AIRS 6.7 micron band
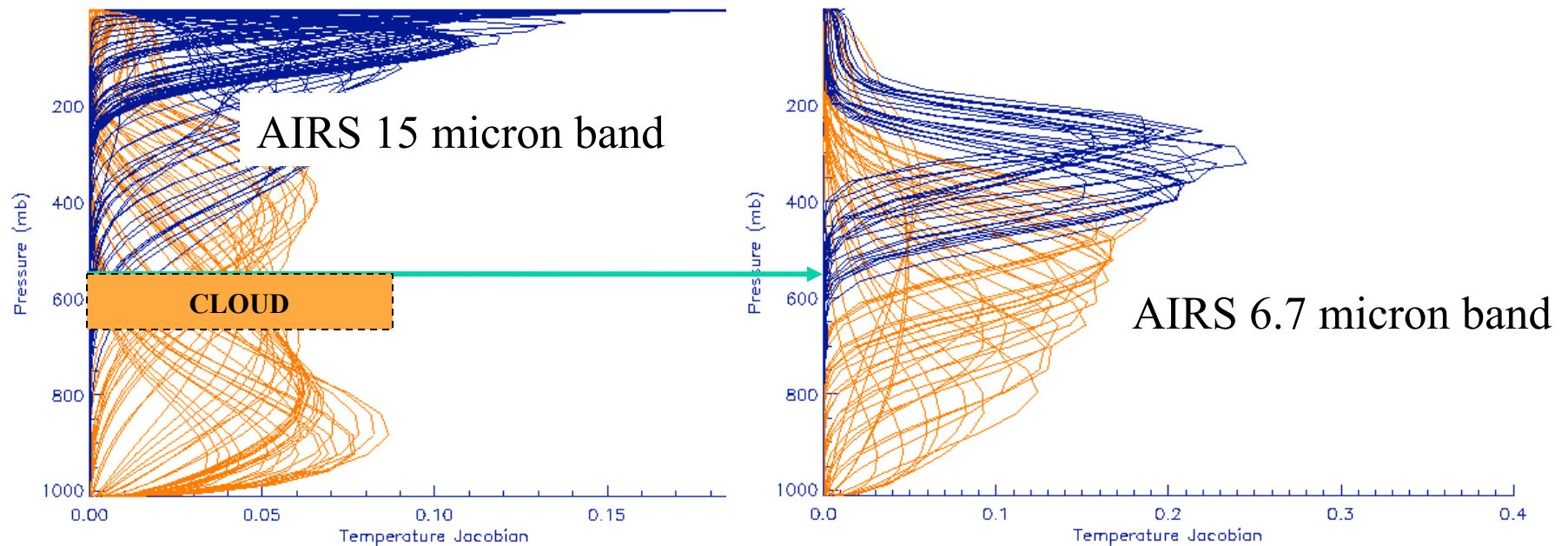
Use of the 15micron information gives a significantly better identification of clear water vapour channels and less skewed departure statistics
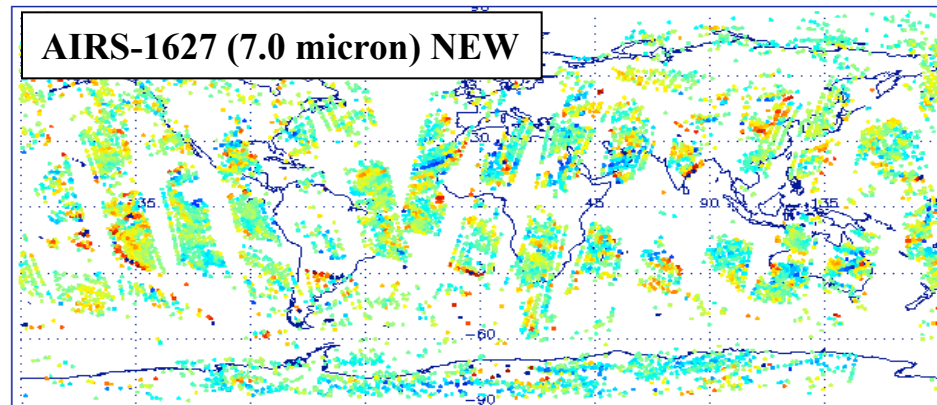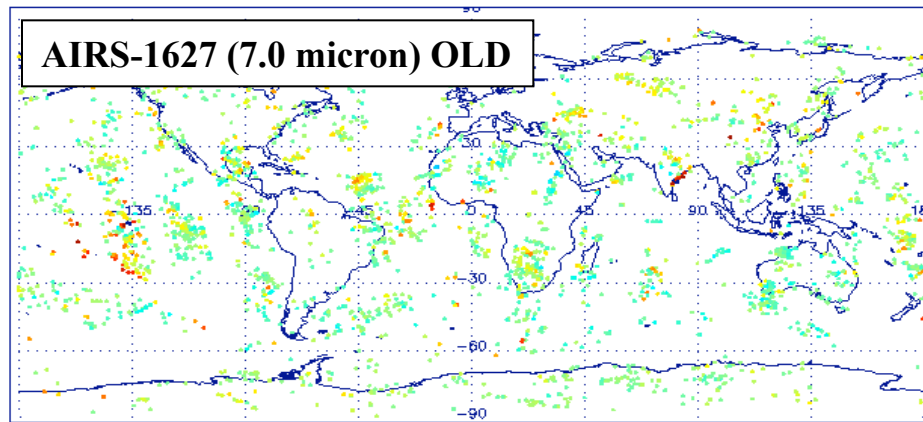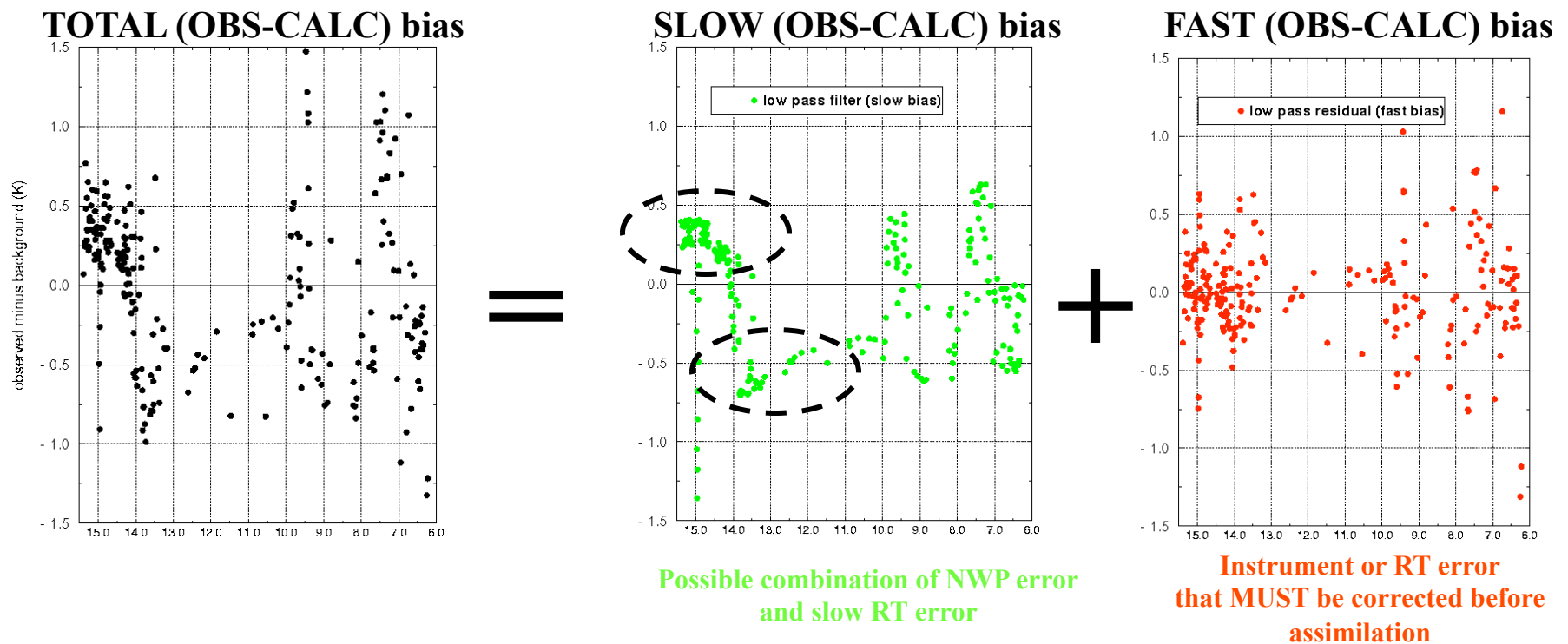
Bias correction

Filtering systematic (obs-calc) radiance departures in vertically ranked space

• Diagnosing biases in the AIRS data and / or RT model is complicated by the presence of systematic errors in the NWP estimate of the atmospheric state.

• However, we know that the NWP errors can only contribute to *slowly varying* modes in a vertically ranked channel space (such that used in the cloud detection scheme).

• Thus filtering the OBS-CALC statistics in a ranked space allows some separation of the different bias components.

# Filtering systematic (obs-calc) radiance departures in vertically ranked space

TOTAL (OBS-CALC) bias

SLOW (OBS-CALC) bias

FAST (OBS-CALC) bias

Possible combination of NWP error and slow RT error

Instrument or RT error that MUST be corrected before assimilation

Allows a much better cross checking of results with other sources (e.g. CAMEX and results from UMBC etc…)
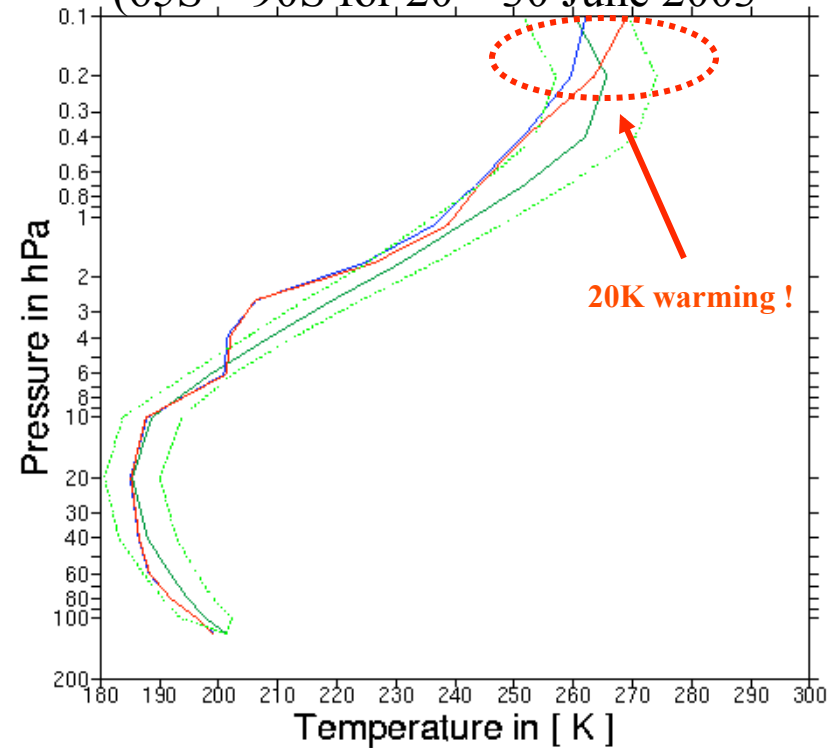
AIRS increments in the stratosphere

AIRS increments in the stratosphere (2) (improving the mesosphere)

ECMWF fit to passive MIPAS temperature data

26R3 – **WITHOUT AIRS** radiances
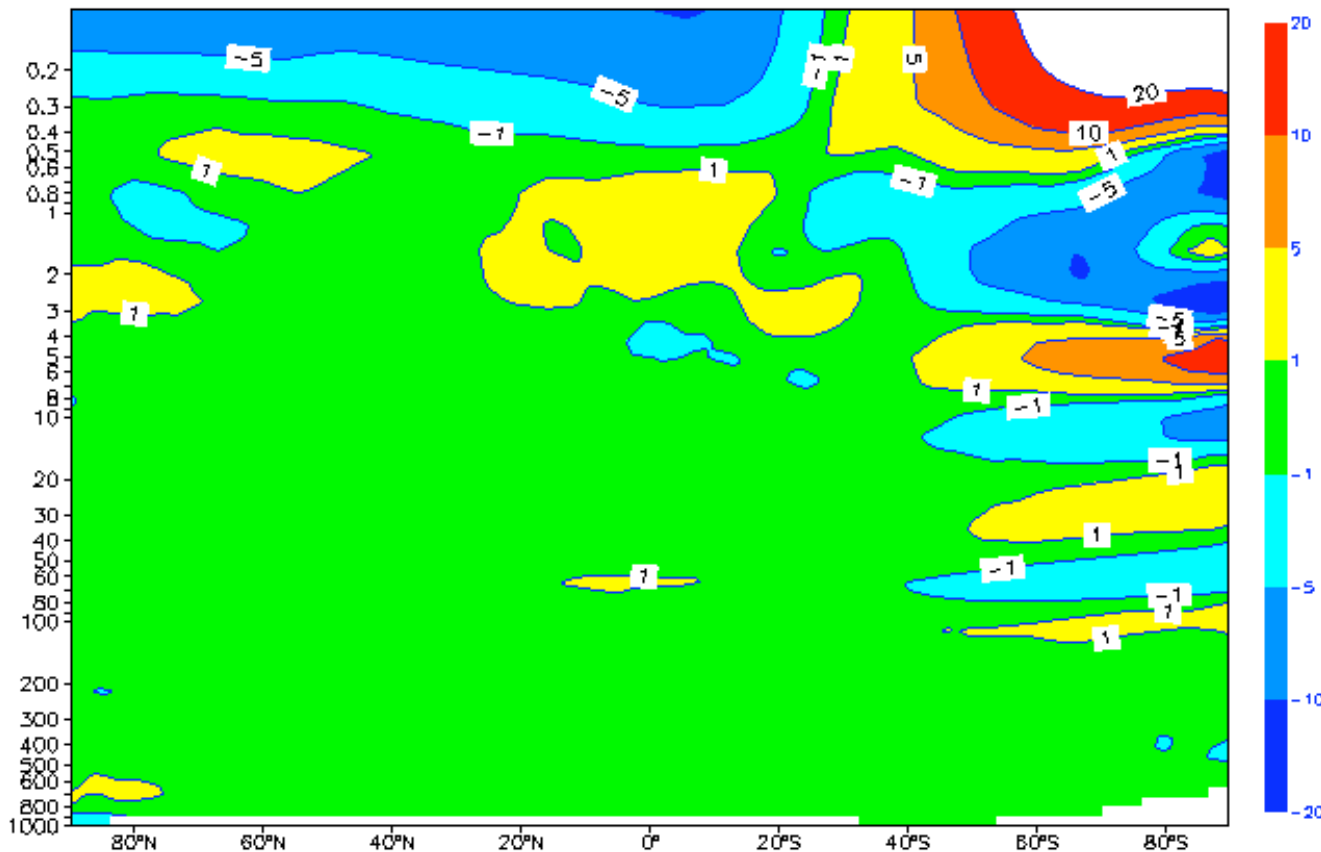(65S – 90S for 20 – 30 June 2003
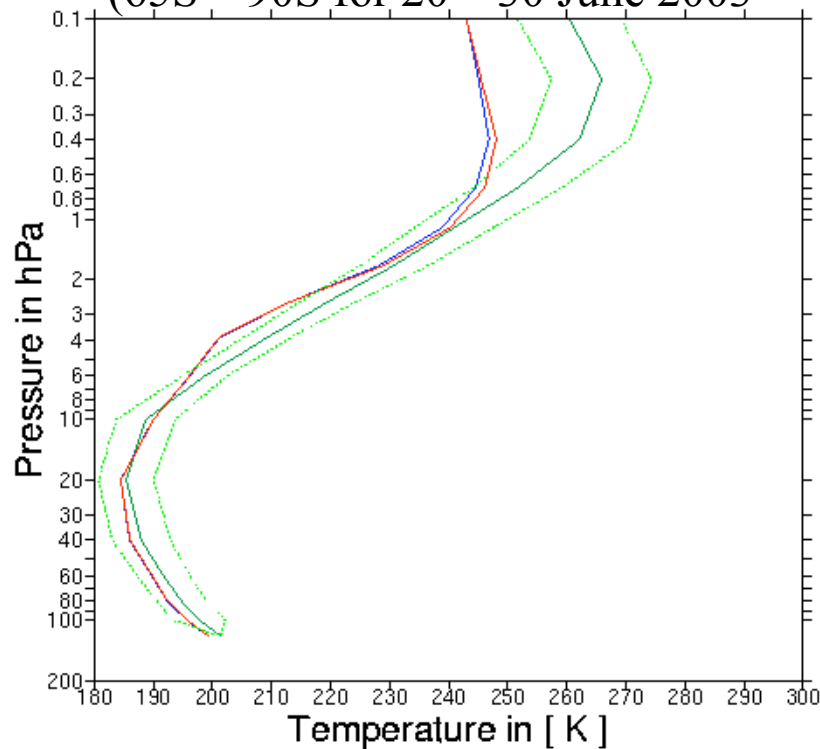
26R3 – **WITH AIRS** radiances
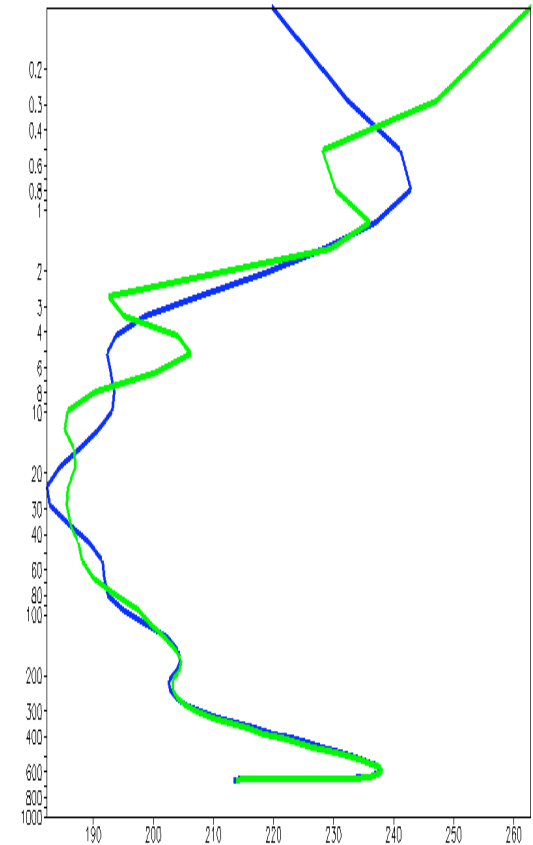(65S – 90S for 20 – 30 June 2003

20K warming !

AIRS increments in the stratosphere (3) (the so called "ringing" problem)

Zonally averaged temperature change (esuite minus OPS)

Temperature profile at S.pole in June 2003 (esuite and OPS)

Planned AIRS operational upgrades

Ready for end of year implementation

- New surface emissivity model
- Fix to stratospheric ringing
- Upgrade to bias correction
- Upgrade(s) cloud detection
- Technical modifications

Ready for mid 2004 implementation

- Review of observation error model
- Extra channels shortwave night / O3

Ready for end 2004 implementation

- Non LTE parameterization
- Use / assimilation of EOFs
- Use of cloudy data with sink